TB MED 142

WAR DEPARTMENT TECHNICAL BULLETIN

FILARIASIS (WUCHERERIA) WITH SPECIAL REFERENCE TO EARLY STAGES

War Department, Washington 25, D. C. • • • February 1945

This bulletin supersedes paragraph 9 of SGO Circular Letter No. 33, 1943

This bulletin follows TB MED 141, subject, "Nutritional Value and Characteristics of Certain Expedionary and Packaged Rations." Distribution given TB MED 141 was as follows: AAF (5); AGF (5); ASF (2); T of Opns (25); S Div ASF (1); Dept (5); Base Comd (5); Is Comd (5); AAF Comds (55); Arm & Sv Bd (2); Def Comd (5); Tech Sv (2); SvC (10); Named & Numbered GH (60); Numbered GH (NP) CZ (45); Named SH (Including RH & Numbered SH) (40); M Conc C (55); Gen Disp (ZI) (10); Fld Hosp (15); Hosp Tn (2); Hosp Ship Plat (5); Hosp Ship Complements (15); Conv Ctr (15); Conv Camp (10); Vet Gen Hosp (10); Vet Sta Hosp (10); Vet Evac Hosp (5); Vet Conv Hosp (5); Portable Surg Hosp (5); Evac Hosp (750 bed) (40); Evac Hosp (SM-400 bed) (30); Conv Hosp (20); Gen & Sp Sv Sch (5); Enlisted Techn Sch S (1); USMA (2); ASTPU (3); ROTC (2); Army Med Tng C (60); Ind Sta (10); Sv C Lab (5); A (5); CHQ (5); D (55); AF (55); One copy to each of the following: T/O & E 3-25; 4-45; 4-145; 4-232; 5-35; 5-72; 5-95; 5-275; 6-35; 6-55; 6-65; 6-75; 6-95; 6-175; 6-325; 6-355; 6-365; 6-395; 7-85; 9-12; 11-25; 17-55; 17-125; 18-25; 19-35; 20-42. Two copies to each of the following: T/O & E 2-22; 4-152; 4-260-1; 5-386; 5-535S; 6-12; 6-45; 8-22; 8-26; 8-520; 9-35; 9-76; 10-22; 10-165; 10-217; 11-15; 17-15; 18-10-1; 18-35; 19-55; 20-46; 44-15; 44-25; 44-75; 44-115; 44-125; 44-225S; 44-315; 55-120-1. Three copies to each of the following: T/O & E 5-192; 7-95; 8-27; 10-45; 10-175; 17-115; 44-135; 44-320; 55-110-1; T/O & E 5-21 (5); 5-251 (6); 5-510S (35); 8-28 (10); 8-510 (15); 8-534 (5); 8-537T (15); 8-550 (60); 8-550S (45); 8-560 (40); 8-572S (5); 8-580 (40); 8-581 (30); 8-590 (20); 8-591T (15); 8-595T (10); 8-650 (10); 8-750 (10); 8-760 (10); 8-780 (5); 8-790 (5); 10-95 (7); 10-125 (6).

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1. GENERAL. This bulletin refers to filariasis which is due to infection of the lymphatic system with nematode worms of the genus *Wuchereria*. The best known and most widely distributed species is *W. brancrofti*. The only other known species is *W. malayi*. In general, except where otherwise noted, the statements in this bulletin may be considered to apply to infections with either worm.

2. EPIDEMIOLOGY. *a. Geographic distribution.* Although filariasis is widespread among natives of practically all tropical regions, a high incidence of infection is usually found only in limited areas. The exact distribution of filariasis is known for only a relatively small portion of the extensive regions in which the disease occurs.

(1) Infection due to *W. bancrofti* is endemic in a wide belt around the world, between latitudes 30° north and 20° south. (See fig. 1.) In most places its distribution is "spotty," large variations in incidence often being noted in adjacent villages. Also, it is not found in some tropical regions where conditions for spread are apparently favorable. For example, *W. bancrofti* has not established itself in Panama,

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although it is common on many of the West Indian islands, and large numbers of natives with filariasis have migrated from these islands to the Isthmus. In the United States an endemic area of *W. bancrofti* formerly existed in the vicinity of Charleston, South Carolina, but no new cases have been reported in recent years.

(2) The distribution of *W. malayi* is limited to the Far East, where it is found in India, Ceylon, the Netherlands East Indies, Malaya, Indo-China, and South China. (See fig. 2.) It has not been reported from New Guinea or the Philippines.

b. Transmission. (1) The adult worms live in the lymphatic system of man. Female worms release large numbers of sheathed microfilariae (which are prelarval forms) into the lymph and blood streams. Microfilariae are incapable of development in man, and unless they are taken up by a mosquito of an appropriate species, eventually die. In most endemic areas microfilariae of *W. bancrofti* or *W. malayi* are present in the peripheral blood of

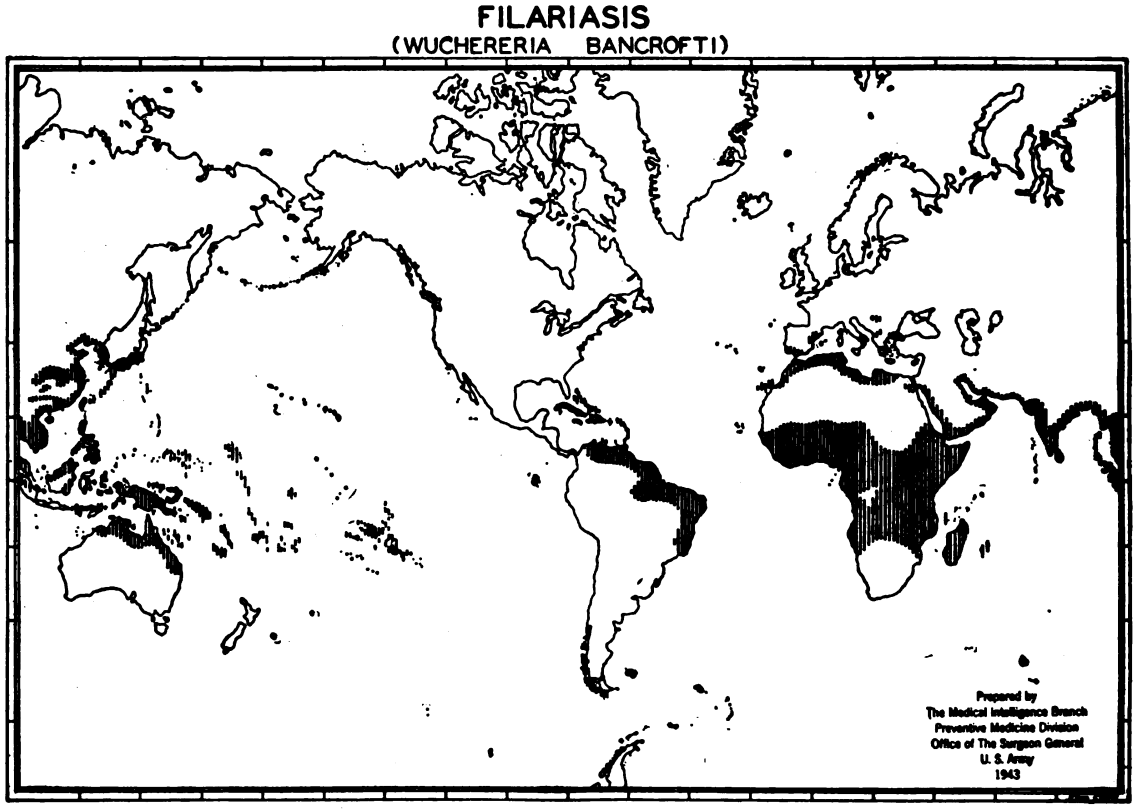

Figure 1.—Geographical distribution of the incidence of filariasis (Wuchereria bancrofti).

infected individuals in greatly increased numbers at night and the mosquitoes which act as intermediate hosts are commonly night-biters. Noctural periodicity in the appearance of microfilariae is not shown, however, by the type of *W. bancrofti* which occurs in many of the South Pacific islands (east of the New Hebrides and Solomons), and in these places the mosquito vectors are day or twilight biters (see *c* below).

(2) In the mosquito, the microfilariae taken up with the blood develop during a period of 10 days or more into infective larvae, which migrate into the mouth parts of the mosquito. When the mosquito then bites again, these larvae are liberated and penetrate the human skin to start a new infection. The interval which is required for the worms to become sexually mature in man and to release a new generation of microfilariae is not known with

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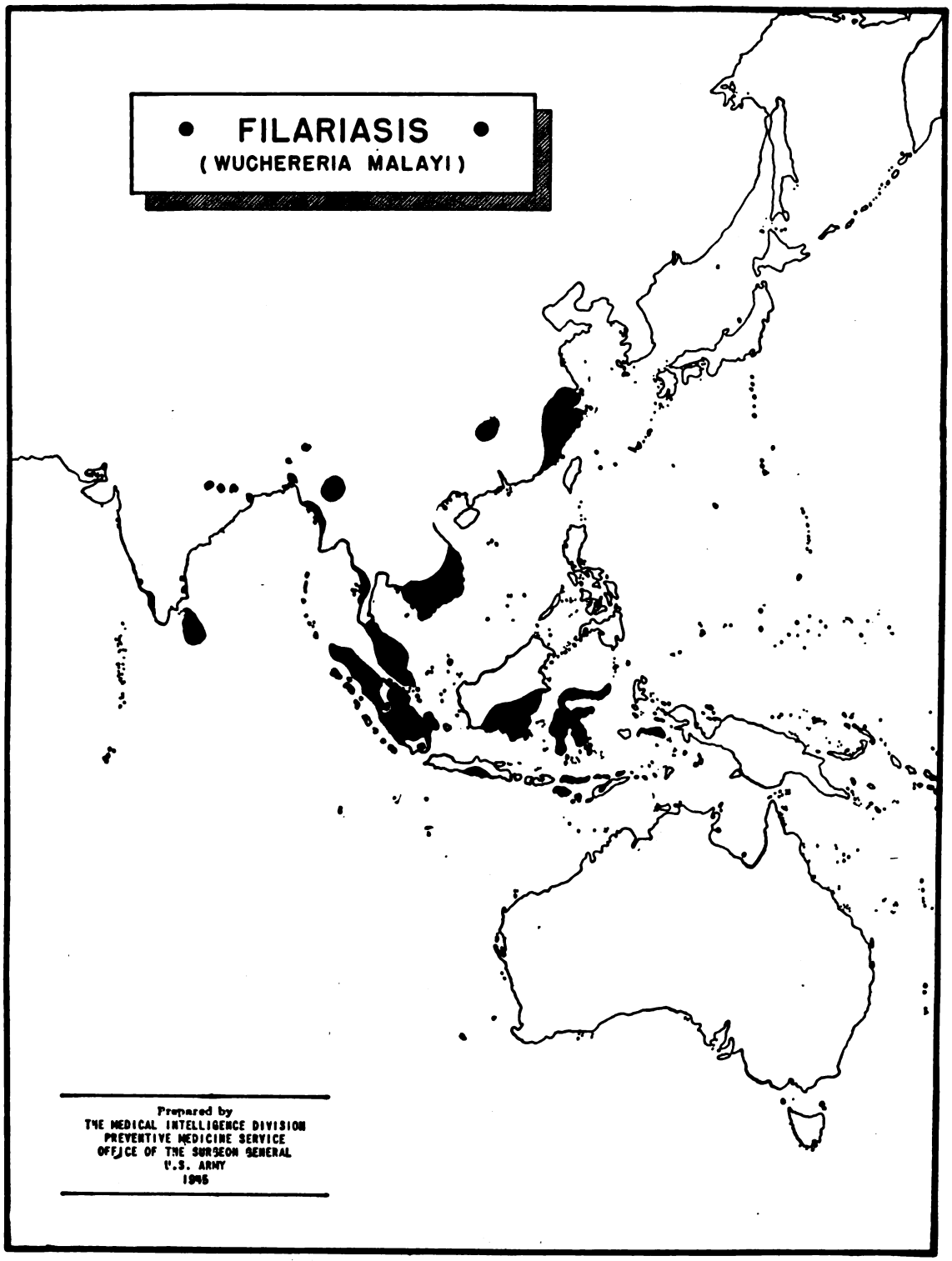

Figure 2.—Geographical distribution of the incidence of filariasis (Wuchereria malayi).

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certainty but is generally estimated to be at least 1 year. A male and a female worm must develop in proximity to one another before a fertile infection can result.

(3) Since only one adult worm can develop from each larva which penetrates the skin, it is not likely that a single bite by an infected mosquito results in the establishment of human disease, as is true for malaria and dengue fever. A high incidence of infection in the human population and a heavy density of efficient mosquito vectors are apparently required for the spread of filariasis. The flight range of the vector, the closeness of association between exposed and infected individuals, and the presence of favorable climatic conditions for the development of the parasite in the mosquito are other important factors in transmission. Because filariasis does not spread easily, infection of nonindigenous persons, while not a great rarity, is uncommon under ordinary circumstances. Experience indicates that close contact with areas in which infected individuals are living, especially during the time of day in which the local vector bites, is generally necessary for infection. Prolonged exposure increases the chance of acquiring the disease.

c. Vectors. (1) *Culex quinquefasciatus* (*C. fatigans*), which has a universal distribution throughout the filarial belt, is generally considered the most important vector of the periodic type of *W. bancrofti.* However, other species of *Culex* and numerous species of *Anopheles*, *Aedes*, and *Mansonia* have been found to be appropriate hosts for this type of filariasis, and may be the chief vector in certain localities. In general, a single species will usually be found to act as the principal vector in a given area. However, in many places the picture will be complicated by the presence of both anopheline and culicine mosquitoes which are responsible for filaria transmission.

(2) *Aedes scutellaris pseudoscutellaris*, a day-biting mosquito, is the principal vector of the nonperiodic type of *W. bancrofti.*

(3) Complete development of microfilariae *of W. bancrofti* has been demonstrated to occur in the mosquitoes and areas listed below. Undoubtedly numerous additional species are appropriate hosts and the species listed probably serve as vectors in areas other than those indicated. The fact that experimental infection has been demonstrated in these species does not indicate the importance of their role as vectors in nature. Comprehensive information on this subject is available only for limited areas. Additional information on the distribution of these species may be obtained by reference to the TB MED on medical and sanitary data of the specific area in concern.

Caribbean and Northern South America: *Anopheles albimanus, Culex quinquefasciatus, Culex habilitator, Aedes aegypti, Aedes taeniorhynchus.*

Brazil: *Anopheles albitarsis, Culex quinquefasciatus, Mansonia juxtamansonia.*

South Central Pacific: *Aedes scutellaris pseudoscutellaris.*

New Hebrides: *Anopheles farauti farauti* and several species of *Culex* and *Aedes* found naturally infected.

Solomon Islands: *Anopheles farauti farauti* and *Mansonia uniformis* found naturally infected.

Australia: *Culex quinquefasciatus, Aedes aegypti, Anopheles amictus.*

New Guinea: *Anopheles punctulatus* (possibly *farauti*).

Netherlands East Indians: Numerous species of *Anopheles* and *Culex.*

Philippine Islands: *Culex quinquefasciatus.*

South China: *Anopheles hyrcanus, Culex quinquefasciatus, Culex pipiens.*

Japan, Formosa, and nearby island chains: *Aedes togoi, Anopheles hyrcanus,* and several species of *Culex.*

Malaya: *Mansonia pseudotittilans.*

India: Many species of *Anopheles; Culex quinquefasciatus.*

Egypt: *Culex quinquefasciatus, Culex pipiens.*

Central Africa: *Mansonia uniformis.*

West Africa: *Aedes aegypti, Anopheles funestus, A. gambiae,* and other anophelines.

(4) The mosquitoes known to be good intermediate hosts of *W. malayi* are *Mansonia annulata, M. annulifera, M. indiana, M. longipalpis, M. uniformis, Anopheles hyrcanus sinensis, A. Hyrcanus X,* and *A. barbirostris*

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barbirostris. The larvae of these species of *Mansonia*, all of the subgenus *Mansonoides*, develop under water in association with certain aquatic plants, such as *Pistia* (water lettuce), *Eichhornia* (water hyacinth), and *Lemna*. The adults are generally night feeders.

3. COURSE. In all probability, many infections remain asymptomatic for years, or even for their duration. The interval from infection to the appearance of symptoms (when they occur) is not well known. In some recent cases, the period from first exposure to the development of symptoms has been as short as 3½ months. It is commonly believed, however, that a period of a year or more frequently elapses. The symptoms and signs may be divided into two general groups, one of which is predominantly early and usually transient, and the other predominantly late and often persistent.

a. Early symptoms and signs. The account which follows relates particularly to early events in the course of filariasis acquired on the islands of the southern part of the Central Pacific region where the nonperiodic variety of *W. bancrofti* occurs. There is some doubt that the same clinical picture occurs as frequently in the early stages of filariasis acquired in other areas. The Samoan native name "Mumu" is often used to designate the clinical picture in question.

(1) The manifestations occur in a series of acute attacks which last from 5 to 6 days or for several weeks. Recurrences are not periodic. It has been observed that strenuous exercise or hard work may precipitate attacks. In the intervals, patients may appear to be in normal health. Acute attacks vary greatly in severity, being sometimes very mild or hardly noticeable and sometimes incapacitating. Among the symptoms are lack of energy and stamina, constant fatigue, anorexia, nausea, headache, vertigo, drowsiness, blurring of vision, photophobia, and muscle spasm. Pain is common, but rarely severe. It occurs in the chest, lower abdomen, muscles, and in association with local swellings and lymphangitis. Fever, chills, and prostration are unusual, except in mild degree. Neurotic symptoms are frequent and mental depression may be severe.

(2) The physical signs are largely those of enlarged lymph nodes, other localized swellings, and lymphangitis. Involvement of the genitalia is especially frequent, with retrograde funiculitis, epididymitis, orchitis, varicocele, and edema of the scrotal skin. There is no evidence that early filariasis has any deleterious effect upon the sexual functions. Swollen lymph nodes, which are rubbery in consistency and remain discrete, appear in the inguinal, cervical, axillary, or epitrochlear regions. Lymphangitis may develop in the arms, neck, or thighs. It proceeds in a retrograde or centrifugal direction, in association with a red streak, under which the enlarged vessel may be palpable. In some instances, circumscribed, localized areas of swelling occur in the arms or legs, which are dull red, tense, and edematous. Urticaria is occasionally seen. Other changes in the skin are rare. Conjunctivitis may be present. Pleural friction rubs have been heard. Anemia does not develop, unless other causes are operative. A moderate leucocytosis is present in about one-third of the cases. Since intestinal parasites are often present, they must be taken into account in estimating the significance of eosinophilia which occurs in about two-thirds of cases. The urine shows no significant changes.

(3) The swellings which have meen mentioned usually involve the genitalia and one or more extremities. They show only moderate tenderness and rarely suppurate. All of the changes described may develop rapidly and may regress just as quickly, so that the picture changes greatly in 12 to 24 hours. Repeated or prolonged attacks occasionally leave behind them enlargements or thickenings, usually of lymph nodes or genitalia (especially the spermatic cord), which are rarely marked, but may be detectable in the intervals between acute attacks.

(4) It has been demonstrated in many acute attacks that there is no concomitant bacterial infection. Such infections, therefore, are not necessarily an essential part of this picture. The clinical manifestations have no relation to the presence of microfilariae in the blood. Furthermore, the early swellings are clearly not due to mechanical blockage of lymph channels by

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worms. The theory that an allergic mechanism underlies the early attacks has been suggested by many observers and has much to commend it. Available information is inadequate, however, to justify the acceptance of any theory at present.

b. Late symptoms and signs. As a rule, the manifestations which characterize the later stages of filariasis are associated with permanent changes in the tissues. The characteristic developments include lymph node enlargement and the condition known as elephantiasis. Since this condition is sometimes caused by other infections, the term "elephantiasis" should not be used as an equivalent of "filariasis." Elephantiasis consists of permanent, extensive thickening and swelling of the soft tissues, with enlargement of the part affected. Any portion of the body may be affected, but the genitalia and the extremities, especially the legs, are most often involved. At least in part, the change is a consequence of more or less complete occlusion of the local lymphatic drainage. Some investigators believe that bacterial infection plays an important etiological role. The development of late manifestations has no relation to the presence of microfilariae in the blood. It is generally believed that many years of repeated infection with filariasis are required for the development of elephantiasis. Among natives of endemic areas who are exposed to the disease from birth, the condition is rarely seen before the age of 20. It is by no means a necessary consequence of infection, since heavily infected populations may show it in only 5 percent or less of their numbers. Chylous effusions in the chest and, especially, the abdomen and chyluria are occasional late manifestations. Extensive abscesses may develop in the soft parts of the extremities or the wall of the trunk. Acute attacks, similar to those described in *a* above, but more often associated with chills and fever, may occur. So far as is known, no case has appeared to date in Army personnel in which elephantiasis has developed following filarial infection acquired during the present war.

4. DIAGNOSIS. The diagnosis of filariasis should be made not only when the presence of the disease is proved by the demonstration of microfilariae or adult worms, but also when the history and clinical findings provide sufficient evidence thereof. It is important that Medical Department records show this diagnosis in all cases in which a reasonable basis for it exists.

a. History and clinical findings. (1) The most important considerations are outlined below. Exposure to the disease in an area where it is known to be endemic is essential. (According to experience during the war to date, filariasis in Army personnel has been acquired only by troops stationed on islands in the South Pacific.) Prolonged close association with natives known to have filariasis should be noted. The interval between first exposure and first symptoms is characteristically long (3 or 4 months to 1 year or more). Recurrent attacks should be given great weight, when manifestations of the group described in paragraph 3*a* substantially repeat themselves.

(2) The most significant signs are characteristic lymph node enlargement, involvement of the genitalia and, especially, retrograde lymphangitis. The diseases which most frequently need to be excluded are malaria and various bacterial infections. Among the latter, streptococcal and gonococcal infections, syphilis, and tuberculosis should receive special consideration. Appendicitis, hydrocele, and hernia should not be overlooked. In many cases, the diagnosis is difficult or impossible when acute manifestations are absent. Experience furnishes the only reliable guides. Exercise tests, particularly marching, are helpful, if they participate acute attacks, as often happens.

b. Laboratory studies. The demonstration of microfilariae or of the adult worm is the only proof of the presence of filariasis.

(1) Microfilariae have been found unquestionably in only a few instances among soldiers infected in the Pacific during this war. Nevertheless, the search for them should always be made and repeated at intervals. Microfilariae may be discovered in preparations of the blood or aspirated contents of a lymph node or hydrocele. In general, they are present in the circulating blood in greatly increased numbers at night (2200 to 0200 hours), but in infections

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acquired on Pacific islands east of the New Hebrides, there is no periodicity. Whenever worms are found, the species should be identified, preferably by a trained parasitologist. In any case, a full description should be recorded immediately, the preparation should be preserved, and the finding should be eventually confirmed. In well-established infections, such as those often found in natives, microfilariae are readily demonstrable in thick-blood films. In cases showing early manifestations of the disease, the concentration method of Knott should be used. A brief description follows: Withdraw 1 cc of blood from a vein and discharge into 10 cc of 2 percent formalin solution in a 15-cc conical tip centrifuge tube. Thoroughly mix and set aside to sediment for 12 to 24 hours. Decant the supernatant fluid and with a capillary pipette containing a small amount of water remove the sediment and make an even, fairly thin smear on a glass slide. When dry, stain with Loeffler's methylene blue for 2 or more minutes, rinse free of excess stain, and when dry, counterstain for 1 to 2 minutes with ⅓ percent aqueous solution of eosin. Giemsa stain may also be used. In the formalized sediment the microfilariae lie stretched out and not in the graceful curves seen in thin and thick blood smears. Since the microfilariae measure about 300 micra in length, they are easily visible under the low power of the microscope.

(2) Adult worms have been demonstrated in about 30 percent of the recent Pacific cases in which biopsies of lymph nodes have been studied. Substantial verification has thus been secured of the general reliability of these diagnoses. Excision of lymph nodes or other tissue while acute symptoms are present is sometimes followed by severe exacerbations and might lead to more serious consequences. It should not be performed at such times. In the complete absence of acute manifestations and under expert guidance, a lymph node may be removed for study. The removal of other tissue is undesirable at any time. The selected node should be at least moderately enlarged, firm, and free from adhesions. The operative technique and post-operative dressing should be unimpeachable. Patients should be kept in bed for at least 5 days. The preparation and study of sections should be done by a trained pathologist. The findings should be fully recorded and the slides should be carefully labeled and preserved. Sometimes in long-established infections, the presence of adult worms may be inferred from wirelike calcifications in the lymphatic system as demonstrated in roentgenograms.

(3) Other laboratory studies are helpful only in connection with clinical findings. Leucocytosis and eosinophilia, which may be present, are not specific. Skin tests and complement fixation tests have been used, which usually employ an antigen derived from *Dirofilaria immitis*, a related species which occurs in dogs. They are not strictly specific and the technique has not been thoroughly standardized. For the skin test, it is important that such antigens be used in very dilute form (1 to 8,000 is recommended) and that adequate controls be conducted. The possibility of infection with intestinal nematodes should be investigated. The results of these tests may be helpful in conjunction with other findings, especially in groups of patients, but they require critical evaluation. Further information about such tests may be secured from The Surgeon General by any Army hospital or medical laboratory having to do with a sizable group of patients suspected of filariasis. To a certain extent, the microscopic pathology of tissues acutely involved in the early stages of the disease is suggestive, but this fact cannot be applied in routine diagnostic studies.

5. TREATMENT. *a. General measures.* During acute attacks, patients should be kept in bed. Compresses, either hot or cold, should be applied over local inflamed areas. When swellings appear, the part should be elevated. A specially devised scrotal support is necessary, if the scrotum is enlarged. X-ray treatment of acute filarial lymphangitis or adenitis is of doubtful value and may be harmful. In the presence of acute manifestations, all surgical operations are considered undesirable, except such as may be clearly indicated as emergency measures. The treatment of elephantiasis is not discussed in this bulletin.

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b. Drugs. No efficacious specific chemotherapeutic agent is known. If trials of drugs as antifilarials are undertaken, approval of The Surgeon General should be obtained, or in oversea areas, that of the theater surgeon. Although sulfonamides have no known effect on filariasis itself, sulfadiazine may be given in cases in which evidence exists of secondary infection with susceptible bacteria. The usual precautions should be taken, including care to insure an adequate urinary output. Sedatives should be given as necessary for the relief of serious discomfort or restlessness.

c. Psychological management. Patients with filariasis may suffer greatly from worry over the possible outcome of the disease and fear of transmitting it to their families and others. These worries and fears are due especially to lack of knowledge of the disease, abseration of cases of elephantiasis among natives, and involvement of the genitalia. Throughout the treatment, the medical officer should bear in mind the great importance of gaining the patient's confidence, of explaining to him in ordinary language the elementary facts about the transmission, nature, and course of filariasis. In the light of present knowledge of the disease, it is justifiable and desirable to reassure patients and to explain to them that, although they may have further transient attacks, the chance of serious permanent damage is negligible.

d. Convalescence and reconditioning. Following acute attacks, patients should slowly resume normal activities. They should not be kept in bed or in a regular hospital ward any longer than is necessitated by the occurrence of symptoms. As soon as possible, they should enter a reconditioning program which should be modified, if necessary, to suit their needs. Careful supervision and proper psychological management, with due attention to morale building, are essential.

6. PROGNOSIS. Filariasis itself presents no significant threat to life. In the great majority of instances, the signs which develop during the early stages are entirely transient. Experience indicates that as time goes on the remissions lengthen and the recurrences become milder. Many soldiers with the diagnosis of filariasis, in the absence of symptoms, have demonstrated their ability to perform military duties satisfactorily. The risk of the development of permanent lesions, including elephantiasis, is not known in statistical terms. In view of the low incidence among heavily infected natives of endemic areas, this risk is believed to be very small for individuals who have not had long exposure to repeated heavy infections and are removed from further exposure.

7. DISPOSITION. In regard to the diagnosis of filariasis, see paragraph 4. Patients with a diagnosis of filariasis should be—

a. Evacuated to the United States, if they are in an area where filariasis is endemic.

b. Hospitalized until they are free from symptoms and clinical signs or eligible for separation from the service as described in *d* below.

c. Returned to duty after a reasonable period of freedom from clinical manifestations and suitable reconditioning. This period is estimated to average about 3 months. The presence of microfilariae in the blood alone is not a basis for prolongation of hospitalization or other restriction. Such patients should be classified for service limited to the United States.

d. Separated from military service for filariasis only if permanently incapacitating residuals or sequelae of the disease are present after maximum benefit of hospitalization is obtained.

8. PREVENTION. *a. General.* The prevention of filariasis depends primarily upon segregation of troops at a safe distance from infected native populations, control of mosquito vectors, and individual protection from bites of mosquitoes.

b. Segregation of troops from natives. Since infected natives serve as the reservoir of filariasis and thus are the source of infection for troops, the maintenance of a safe distance between the two groups and a restriction of their association to a minimum is of the utmost importance for the prevention of the disease in military personnel. Camp sites should be located at least 1 mile from native habitations. If for military reasons it is necessary to make

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permanent camp sites in proximity to native villages, the latter should be moved to other locations. In areas where filariasis is prevalent, native laborers should be examined for microfilariae and only individuals who are negative should be permitted to work in contact with troops. All other natives should be excluded from troop areas. The practice of permitting natives to attend camp movies is particularly condemned. Native villages should be declared out of bounds at all times and the regulations enforced.

c. Control of mosquito vectors. (1) Numerous species of mosquitoes with varied feeding habits and biology transmit filariasis. In areas where the parasite is of the nonperiodic type, day-biting species have been found to be the important transmitters. In other regions, night-feeding anophelines and culicines are the common vectors. Every effort should be made to ascertain the type of filaria involved and the important mosquito vectors. Where the same mosquito transmits both malaria and filariasis, the malaria control program should amply provide the needed protection against filariasis. In the absence of specific information, methods directed at the control of all species of mosquitoes should be employed.

(2) All feasible and practical larvicidal measures including those employed in malaria control (see FM 21–10 and TB MED 14) should be instituted. In addition to the anopheline habitats emphasized by malaria control, careful attention must be given to the numerous types of natural and artificial water collections which serve as breeding places for *Culex* and *Aedes* mosquitoes. Thorough policing of camp areas for tin cans, coconut husks, oil drums, tire casings, and other sources of mosquito breeding should be practiced routinely. Breeding of *Mansonia* mosquitoes cannot readily be controlled by surface larvicides, since the larvae live in association with aquatic plants, obtaining air through the roots. When drainage is not practicable, their numbers may be reduced by clearing of all water lettuce and water hyacinth plants from breeding areas near camps.

(3) Particular emphasis should be placed upon measures directed against adult mosquitoes, including: the application of DDT residual spray to troop quarters and to native huts (see TB MED 110); barrier treatment of camp sites with DDT; screening; clearing area of vegetation when the tactical situation permits; and routine insecticidal spraying of all buildings and quarters both during the day and in the evening, depending upon the habits of the mosquito vector. The treatment of native habitations with DDT residual spray is especially important because this procedure has long-lasting effects and will kill many mosquitoes soon after they become infected. Destruction of infected mosquitoes breaks an essential link in the chain of transmission of the disease.

d. Individual protective measures. Personal antimosquito measures, as applied against malaria mosquitoes, will also afford protection against the common vectors of nocturnal filariasis. Insect repellent and mosquito bars should be used routinely. Long-sleeved shirts and full-length trousers should be worn at all times during the day, and in the evening until retiring under the protection of bed nets. In areas where troops are exposed to the nonperiodic type of *W. bancrofti*, transmitted by day-biting culicine mosquitos, the application of repellent repeatedly during the day is recommended.

[AG 300.5 (12 Feb 45)]

BY ORDER OF THE SECRETARY OF WAR:

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Chief of Staff

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The Adjutant General

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For explanation of symbols see FM 21-6.

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